National Aeronautics and Space Administration

technology opportunity

Programmable Motion System

Remotely controlling motorized positioning devices with user-friendly format

Researchers at NASA's Glenn Research Center have developed a programmable motion system for remotely controlling motorized devices. A combination of hardware and software, the system enables users to control the speed, position, and other parameters of motion for each axis via preprogrammed profiles that can be edited in real time using standard, everyday software applications. The system is programmable logic controller (PLC) based, leading to highly accurate and reliable positioning ability. A software-based human machine interface (HMI) package adds flexibility to the overall system. The innovation is flexible, field programmable, fast, expandable, and compatible with data-acquisition and control systems.

Benefits

- **Accurate:** Accommodates auxiliary positioning devices and maintains continuous communication with any control or data-acquisition system
- **User-Friendly:** Provides for real-time editing of axis parameters, integrated profile programming, and point-and-click mouse input
- **Customizable:** Allows for programming in the field
- **Expandable:** Permits entire system upgrades or smaller expansions to accommodate changing needs
- **Flexible:** Provides potential for operators to use familiar existing equipment, independent of specific motor-driven circuits or motors
- **Low electromagnetic interference (EMI):** Allows usage with EMI sensitive probes, or in environments containing EMI-sensitive instrumentation

Applications

The innovation is suited for applications in the following industries:

- Automotive (studying the aerodynamic performance of vehicles in wind tunnels)
- Manufacturing (moving valve actuators, robotic assembly devices, and automated tools in industrial settings)
- Aerospace (positioning pressure, temperature, and flow angle probes in research facilities)
- Medical (adjusting parameters in real time for robotic surgery and radiographic imaging)
- Environmental sciences (monitoring and moving probes in hostile environments)

Technology Details

How It Works

This field programmable motion system consists of three main parts: a PLC running the motion system control program, a personal computer running an HMI application, and a motor-drive system, with its associated gears, ballscrews, and other external components. The PLC, HMI, and motor-drive subsystems all operate together to control the speeds and positions of all 18 axes of motion. The system guides a mechanism's position using several standard commands:

- Move to a specified absolute position
- Move to a specified positive or negative increment from the present position
- Find the home position
- Jog in the positive or negative direction
- Move according to an external parameter or signal

A particularly notable feature is the minimal communications overhead for interfacing to other systems such as data acquisition or control systems, resulting in communication speeds that are 3-5 times faster than traditional systems. In addition to reducing the time required to execute motion commands or take research data, real-time editing of axis parameters, integrated profile programming, and point and click operation all serve to simplify system operation.

Why It Is Better

Early motion control systems typically were cumbersome, difficult to use, not field programmable, slow to take data, difficult to set up and troubleshoot, and quite expensive. In response to demand for applications requiring precise motion control, innovators at Glenn designed a system that is versatile, user-friendly, and adaptable to users' needs. Although originally developed to control probe actuators, the system can be used to control action of movable stator vanes, laser tables, or any other device that accepts a ±10 VDC velocity signal.

Patents

Glenn has patented this technology (U.S. Patent No. 6,308,113).

Licensing and Partnering Opportunities

Glenn's Technology Transfer and Partnership office seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to discuss partnership opportunities involving this programmable motion system technology (LEW-16690-1) for commercial applications.

For More Information

For more information about this and other technology licensing opportunities, please visit:

Technology Transfer and Partnership Office
NASA's Glenn Research Center
E-mail: ttp@grc.nasa.gov
Phone: 216–433–3484
http://technology.grc.nasa.gov/